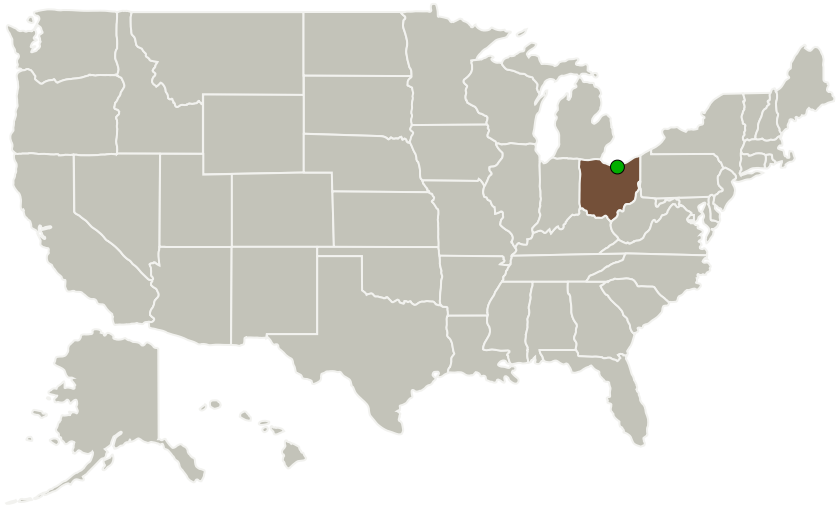
Innovative Stirling-Cycle Cryocooler for Long Term In-Space Storage of Cryogenic Liquid Propellants, Phase II

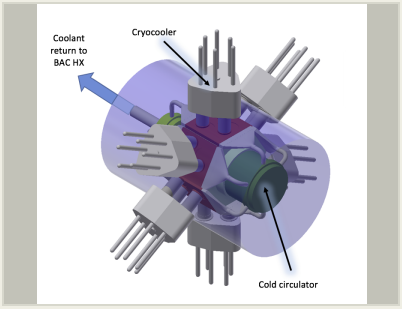
Completed Technology Project (2017 - 2019)

Project Introduction

Under this Phase II SBIR project we will build and test a stirling-cycle cryocooler and coolant circulating subsystem for use with broad area cooling (BAC) systems to deliver reduced or zero boil-off propellant storage. We will also refine the design of an innovative linear-reciprocating cold-circulator that resides at the same temperature as the BAC coolant, although we will not have the resources to build this component in Phase II. Compared to conventional reverse turbo-brayton cycle cooling technology our stirling-cycle technology offers higher cooling efficiency and requires no bulky recuperator component. Our double-acting stirling cycle configuration combines a linear motor with a moving piston/regenerator assembly into a self-contained module. A number of such modules can be connected together into several possible cryocooler layouts to scale heat lift capacity, achieve system redundancy and provide flexible integration with the BAC coolant loop. This modular approach provides the system designer with packaging options not available with conventional stirling cryocoolers.

Primary U.S. Work Locations and Key Partners





Innovative Stirling-Cycle Cryocooler for Long Term In-Space Storage of Cryogenic Liquid Propellants, Phase II Briefing Chart Image

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Completed Technology Project (2017 - 2019)

Organizations Performing Work	Role	Type	Location
Converter Source, LLC	Lead Organization	Industry	Athens, Ohio
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations
Ohio

Project Transitions

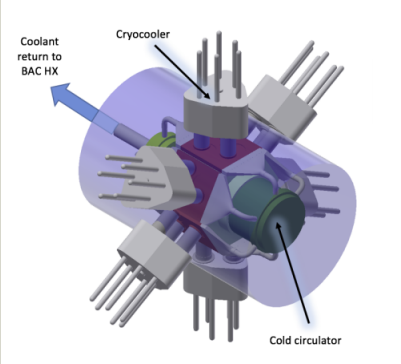
June 2017: Project Start

December 2019: Closed out

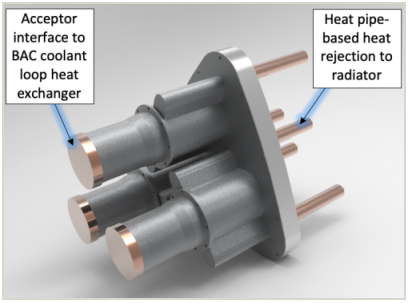
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141139)*

Images



Briefing Chart Image
Innovative Stirling-Cycle Cryocooler for Long Term In-Space Storage of Cryogenic Liquid Propellants, Phase II Briefing Chart Image *(https://techport.nasa.gov/image/132324)*



Final Summary Chart Image
Innovative Stirling-Cycle Cryocooler for Long Term In-Space Storage of Cryogenic Liquid Propellants, Phase II *(https://techport.nasa.gov/image/128168)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Converter Source, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

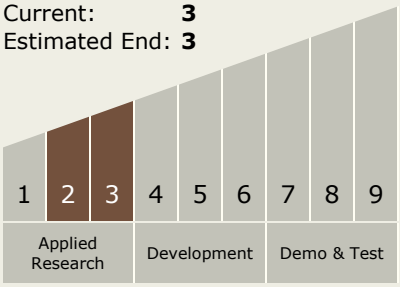
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
James Huth

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Completed Technology Project (2017 - 2019)

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System